

REPORT BY THE
AUDITOR GENERAL
OF CALIFORNIA

A REVIEW OF THE
CALIFORNIA DEPARTMENT OF FORESTRY'S
AERIAL FIREFIGHTING PROGRAM

REPORT OF THE
OFFICE OF THE AUDITOR GENERAL
TO THE
JOINT LEGISLATIVE AUDIT COMMITTEE

039

A REVIEW OF THE
CALIFORNIA DEPARTMENT OF FORESTRY'S
AERIAL FIREFIGHTING PROGRAM

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California Legislature

Joint Legislative Audit Committee

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December 2, 1981

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The Honorable President pro Tempore of the Senate
The Honorable Speaker of the Assembly
The Honorable Members of the Senate and the
Assembly of the Legislature of California

Members of the Legislature:

Your Joint Legislative Audit Committee respectfully submits
the Auditor General's report concerning the Department of
Forestry's aerial firefighting program.

Respectfully submitted,

WALTER M. INGALLS
Chairman, Joint Legislative
Audit Committee

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SUMMARY

We have reviewed the aerial firefighting program of the California Department of Forestry (CDF) and found that it is providing competent and responsive airtanker services. Yet having competent and responsive firefighting services will not always protect homeowners and wildlands from fire. Environmental and meteorological factors often reduce the effectiveness of even the best airtanker operations. Under certain conditions of weather and topography, some fires burn so hot and spread so quickly that suppression activities are relatively ineffective. Occasionally, factors such as darkness, high winds, turbulent flying conditions, unusually rough terrain, and low visibility due to smoke preclude the use of airtankers.

Yet given these factors, we found that the CDF provides competent and responsive aerial firefighting services. Specifically, its pilots are qualified and proficient, having undergone a stringent training and testing process. Further, the system for dispatching aircraft, coupled with the strategic location of air bases, ensures that airtankers reach most fires within 20 minutes.

In addition, the California Air National Guard plays a supplemental aerial firefighting role for the State. That is, the guard's aircraft cannot be dispatched until all commercial airtankers under federal contract have been either committed to fires or determined unavailable. Nevertheless, having the guard's aircraft available protects California in the event that additional airtankers are needed.

Our review also indicated that the CDF's contracts with commercial airtanker operators provide for effective cost control. These contracts contain provisions detailing performance requirements for contractors as well as penalties for unsatisfactory performance. We noted that contractors have generally complied with provisions of the contracts. Additionally, the CDF has implemented these contract provisions by adopting procedures that effectively control the costs associated with aerial firefighting.

We examined the roles of state-leased and contractor-owned aircraft in aerial firefighting and found them to be similar. Both are used for initial air attack, and both are supplemental to ground firefighting forces. They differ, however, in that contractor-owned aircraft carry more chemical retardant, are more costly to operate, and are out of service more frequently than are state-leased aircraft.

Further, as requested by the Legislature, we have provided information on the following: airtanker conversion costs, retardant loading policies, aircraft maintenance, and the procurement of surplus military aircraft and parts. We also provide information about the CDF's procedures for managing inventory and the capabilities of various airtankers.

INTRODUCTION

In response to a request by the Joint Legislative Audit Committee, we have reviewed the aerial firefighting program of the California Department of Forestry (CDF). This study was conducted under the authority vested in the Auditor General by Sections 10527 and 10528 of the Government Code. This is the Auditor General's second report on the CDF's aerial firefighting operation. Our previous letter report reviewed aerial firefighting contracts between the CDF and commercial airtanker operators and examined the role of the California Air National Guard in aerial firefighting.* For this second report, the Legislature asked that we focus on the following major issues:

- Adequacy of the CDF's aerial firefighting services;
- The role of the Air National Guard aircraft;
- Contract requirements;
- The role of state-leased versus contractor-owned aircraft.

* This report is entitled, Review of Department of Forestry Aerial Firefighting Contracts with Commercial Airtankers, Report P-016.1, August 1980.

Additionally, we researched the environmental and meteorological factors that affect fire suppression activities and fire prevention methods. This report also provides information on these issues: airtanker conversion costs, capacity and loading policies, maintenance, procurement practices, inventory management, and capabilities of various airtankers.

Background

The State of California has primary financial responsibility for preventing and suppressing fires that threaten the natural resources within the State. To that end, certain state lands have been designated as State Responsibility Areas. In these areas, which are classified by the State Board of Forestry, the CDF provides ground firefighting as well as aerial firefighting services. Fire officials in other areas may request aerial firefighting services from the CDF; however, they must reimburse the State for the cost of those services.

Aerial firefighting is an integral part of the CDF's fire protection operation. Its air attack program is designed to assist firefighters on the ground. To accomplish this

objective, the CDF contracts with private industry for the maintenance and operation of airtankers, helicopters, and observation airplanes.

Most of the CDF's airtankers are surplus military aircraft that have been converted for firefighting use. In 1972, 55 of these aircraft were obtained from the United States Navy under a long-term lease that allows the State to use the aircraft for 15 years at no cost. Of these aircraft, which were formerly used for anti-submarine warfare, 20 were converted for airtanker use; 17 of these are in service today. Other airtankers and helicopters are owned by contractors.*

To complement the CDF's aircraft, federal and local agencies operate airtankers and helicopters within the State. In its California region, the United States Forest Service (USFS) contracts for 13 airtankers that are available to the CDF on a reimbursement basis. The United States Department of the Interior also has available airtankers. In addition, the Los Angeles County and Ventura County fire departments operate firefighting helicopters of their own. Finally, Air National Guard aircraft can be equipped with Modular Airborne

* Normally, the CDF is budgeted for 21 airtankers and 7 helicopters. However, the CDF's budget for the 1980 fire season included a special augmentation that allowed it to contract for additional aircraft.

Firefighting Systems. These aircraft are available to the CDF for aerial firefighting when suitable commercial airtankers under federal contract are not readily available. Because of the cooperative agreements established between agencies, all of the aircraft can be used to augment an agency's firefighting capability.

Scope and Methodology

We focused our review on the CDF's system for managing and providing aerial firefighting services. We examined pilot qualifications as well as the system's responsiveness and its ability to provide effective cost control. We reviewed the procedures for mobilizing the California Air National Guard during emergency fire situations and for procuring aerial firefighting protection. We also examined the firefighting role of state-leased and contractor-owned aircraft. Further, we researched the environmental and meteorological factors that affect fire suppression activities and that sometimes reduce the effectiveness of aerial firefighting services.

Finally, we researched appropriate statutes and policies covering aerial firefighting contracts, inspected department accounting and program records, and interviewed fire officials. We examined contractors' accounting, maintenance,

and flight records. Additionally, in certain local fire districts, we interviewed fire chiefs, representatives of homeowners' associations, and a number of state, local, and federal officials engaged in firefighting activities. Through these interviews, we attempted to determine the quality of the services that the CDF provides.

AUDIT RESULTS

COMPETENT AND RESPONSIVE AIRTANKER SERVICES WILL NOT ALWAYS PROTECT HOMEOWNERS AND WILDLANDS FROM FIRE

Even though the California Department of Forestry is providing competent and responsive aerial firefighting services, these efforts are relatively ineffective in certain situations. Sometimes, for example, fires may build so quickly and become so widespread that they cannot be controlled through firefighting techniques. Also, factors such as darkness, high winds, turbulent flying conditions, unusually rough terrain, or low visibility due to smoke may preclude the effective use of airtankers. As a result of these factors, fires cause considerable property damage before they can be contained by ground personnel.

Yet in fires where airtankers can be used, the CDF has provided responsive and competent aerial firefighting services. Airtanker pilots are well-trained and well-qualified; they have undergone a certification process that includes training courses and proficiency testing. Further, an effective dispatch system and strategic deployment

of airtankers have enabled the CDF to respond quickly to requests for aerial attack. Our review indicated that airtankers can reach almost all fires within 20 minutes.

Factors That Inhibit Fire Suppression Efforts

In California, many fires may be contained before they burn large areas and damage homes and other structures. However, under certain conditions of weather and topography, efforts to control fires are relatively ineffective and fires become large and destructive. These "conflagration fires" are extremely difficult to stop because dry fuels and strong winds cause them to burn intensely and spread rapidly. As an illustration of the damage these fires can cause, less than 1 percent of the State's wildland fires that occurred in 1980 resulted in 44 percent of the burned land area, destroying 463 homes.

Fire suppression methods and equipment are generally ineffective in stopping a fast-running conflagration fire. Firefighters try to establish control over these fires by using bulldozers and other mechanical equipment to construct barriers to the fire. Airtankers may be used to supplement firefighting efforts on the ground by dropping water and chemical retardants at the fire's perimeter.

However, the effectiveness of airtankers decreases as the fire's intensity increases. Aerial fire retardants can be used to impede a fire, but they will seldom extinguish it. For aerial firefighting to be effective, it is essential that ground crews work on the fire's edge soon after the retardant is dropped. But in the case of a conflagration fire, ground crews, and consequently airtankers, can only work on the flank and at the rear because of the hazard posed by the front of a fast-moving fire driven by strong winds and fueled by dry brush. Thus, as the fire grows, it becomes more difficult to stop it. Often, a fire will continue to spread until the high winds cease, the leading edge runs out of fuel, or the fire reaches a location where barriers can be established.

One scene of high intensity fires is the canyon area south of the Tehachapi Mountains in southern California. This area is particularly susceptible to large fires during the dry season when the high "Santa Ana" winds begin to blow. Once a fire starts in the canyons, it is extremely difficult to control, and within minutes the fire spreads rapidly. In a short time, the fire is so widespread that it is usually beyond the control of initial air attack forces. Thus, to suppress such a fire, airtankers and ground forces must wait until the fire burns out or reaches a level at which it may be controlled.

Some prospects for reducing the fuel available for these large fires include clearing vegetation and modifying building codes. Communities in southern California, for instance, have begun vegetation management programs and have passed ordinances requiring the clearing of dense brush or vegetation. In addition, most fire control agencies support stricter building codes to reduce the threat of fire. These efforts are designed to deprive a fire of abundant, dry fuels, thereby reducing its intensity and permitting early control and containment.

Factors Supporting the Adequacy of Airtanker Services

Although there are special conditions that may inhibit even the best fire suppression services, these conditions are unusual. Generally, the CDF has demonstrated competence and responsiveness. We specifically examined the areas of pilot qualifications and response time in reaching this conclusion. These areas are further discussed below.

Pilot Qualifications

We found that the CDF ensures that airtanker pilots are adequately trained, qualified, and proficient by requiring each pilot, prior to the fire season, to complete the airtanker pilot certification process that includes both ground and

flight training. Additionally, during the fire season, CDF flight personnel monitor airtanker performance by evaluating pilots' drop accuracy on each fire and by preparing monthly performance reports, which are used to help improve pilots' techniques. We found evidence that the training and evaluation programs are successful and that pilots are proficient. The proficiency of these pilots was further substantiated by evaluations from air coordinating officers who direct the aerial firefighting operation and from supervisors on the ground who control the overall fire suppression activities.

Prior to each fire season, pilots undergo an extensive training program to ensure that they are qualified for aerial firefighting operations. They must first complete a CDF course that includes instruction on aerial firefighting tactics. After completing the CDF's ground training program, each pilot must demonstrate aerial firefighting proficiency during a flight check conducted by the contractor's chief pilot. Finally, a CDF senior pilot administers another flight evaluation that requires the pilot to perform a practice drop of fire retardant on a simulated fire. An individual passing this flight check is certified as a qualified airtanker pilot for that particular fire season.*

* Each pilot must also possess the appropriate medical and flight certificates required by the Federal Aviation Administration.

Our review of monthly flight evaluation reports indicated that pilots generally perform well. The monthly flight evaluations rate navigation, safety, and other pilot skills. Generally, CDF flight personnel preparing these evaluations rated pilots in the average, above average, or excellent categories for specific performance factors. Written comments on the evaluations generally indicated highly satisfactory performance. We found only one instance in which an airtanker pilot was relieved of his duties and released by the contractor because of unsafe flying practices.

Similarly, ratings of pilots' accuracy in dropping chemical retardant were high. The CDF evaluates the accuracy with which each pilot drops retardant by requiring the air coordinating officer to observe and grade each pilot's performance. We reviewed 299 ratings of retardant drop prepared by the air coordinating officers in the North Cascade Region (northern California) during 1980. Of these retardant drops, 98 percent were rated good to excellent. (Sixty percent of these drops were rated excellent.) Only once was an air drop rated unsatisfactory.

Airtanker Responsiveness

In analyzing the responsiveness of the CDF's air attack program, we verified that it is capable of providing airtanker services when requested. This responsiveness is ensured through contracts established with commercial operators; these contracts require pilots to be prepared for dispatch during scheduled standby hours. Also, the CDF maintains a pre-planned system that dispatches the aircraft nearest to the fire. And by strategically locating its air attack bases, the CDF is able to ensure that airtankers reach almost all fires within 20 minutes. Similarly, air attack bases can quickly reload and relaunch airtankers.

Generally, this responsiveness extends to all State Responsibility Areas (SRAs). Yet, since incorporated areas such as Los Angeles City are not part of the SRAs, these areas must reimburse the State for the cost of fire suppression services. Thus, we found that local governments in incorporated areas were reluctant to request the CDF's services.

The California Department of Forestry's air attack program for fiscal year 1980-81 has increased to 22 airtankers, 13 air-coordination aircraft, and 9 helicopters. In addition,

the CDF can dispatch airtankers of the U.S. Forest Service and the Department of the Interior should these aircraft be located closer to the fire scene. Under emergency conditions, the CDF also has access to out-of-state commercial airtankers and to Air National Guard aircraft.

We analyzed the CDF's airtanker program to determine its ability to maintain both aircraft and pilots in a constant state of readiness and to dispatch and reload these aircraft quickly during fire alerts. We also made other tests and observations to assess the responsiveness of the CDF's air attack program. We surveyed selected fire districts, interviewed Los Angeles City and County fire officials, and reviewed CDF dispatch records. We analyzed response times in relation to the distances flown and the average speed of the aircraft. All of these tests and observations verified that the CDF is responsive and capable of quickly providing airtanker services when requested.

The contracts that the CDF has established with commercial operators to maintain and fly the airtankers contain provisions ensuring responsiveness. Specifically, the contracts require that during standby hours--normally between 10:00 a.m. and 30 minutes before sunset--pilots and ground personnel must remain at the air attack base in readiness for dispatch. Normally, aircraft and pilots, on a rotation basis,

are on standby for nine days of every ten. The tenth day is a mandatory day off for the crew to rest and for the aircraft to receive scheduled maintenance.

Additionally, we found that the CDF maintains a planned system that normally dispatches the aircraft nearest to the fire. This system enables the CDF to respond quickly; aircraft and pilots are ready and available for dispatch 98 percent of the stipulated time.

Further, the CDF has strategically located its 13 air attack bases throughout the State so that airtankers can reach almost all fires within 20 minutes. The location of these bases and the air attack bases of the U.S. Forest Service and Department of the Interior are depicted on the map attached as Appendix A. We examined the fire notification and dispatch logs in the North Cascade Region and found that airtankers did respond to all fires within 20 minutes. Likewise, we found that the air attack bases can quickly reload and relaunch the airtankers. A sample of dispatch logs located at Sonoma Air Attack Base indicated that airtankers landed, reloaded to capacity, and took off again in less than 10 minutes.

Although we found that the CDF provided competent and responsive aerial firefighting services, fire officials in incorporated areas were reluctant to request the CDF's airtanker services. This reluctance exists because current laws specifically exclude incorporated areas from SRAs; the State is not financially responsible for fire suppression in incorporated areas. As a result, incorporated areas that request the CDF's airtankers must reimburse the State for the cost of those services.

We further found that the use of the CDF's aerial firefighting services in incorporated areas partially depended upon whether these local governments budgeted for such services. For example, officials of the City of Los Angeles fire department were not inclined to request aerial firefighting services from the CDF since the city does not budget for such services. For the same reasons, fire chiefs of other fire departments in incorporated areas also expressed an unwillingness to request aerial tankers.

CONCLUSION

Under certain topographical and meteorological conditions, aerial firefighting techniques are ineffective. Fires may become uncontrollable in areas where they are fed by dry fuels and fanned by

high winds. In addition, rough terrain, gusty winds, darkness, and poor visibility caused by smoke further impede the use of airtankers.

Yet in conditions where fires are controllable, the California Department of Forestry provides competent and responsive aerial firefighting services. The pilots are well-trained, well-qualified, and proficient in aerial firefighting tactics. Furthermore, the CDF's contracts require commercial operators to be prepared for dispatch during certain periods. Finally, the CDF has strategically located its air attack bases throughout the State so that airtankers can quickly respond to most fires.

THE CALIFORNIA AIR NATIONAL
GUARD PLAYS A SUPPLEMENTAL
ROLE IN AERIAL FIREFIGHTING

In examining the role of the California Air National Guard in aerial firefighting, we found that the guard's aircraft are mobilized for firefighting only when suitable commercial airtankers are unavailable. The response time for guard aircraft exceeds that of commercial airtankers because of the complicated federal policy for activating and dispatching these aircraft. Guard aircraft, by federal policy, are to be used as airtankers only as a last resort and only when all other available airtankers have been committed. Although the California Air National Guard cannot respond very quickly, it is better for California to have the guard's aircraft available even as a last resort than not to have them available at all.

The California Air National Guard maintains a squadron of C-130 aircraft at the Van Nuys airport. Also at this location, the United States Forest Service (USFS) maintains three of the Nation's eight Modular Airborne Firefighting Systems (MAFFS). These units are the only ones located in California. Each of these units, when loaded aboard the C-130 aircraft, can deliver 3,000 gallons of fire retardant. However, it normally takes about 24 hours to mobilize these aircraft.

This amount of time is needed for the Air National Guard to respond because of federal policy and the procedures for dispatching guard aircraft. An operations plan and a federal memorandum of understanding between the Department of Defense and the Departments of the Interior and Agriculture outline the procedures for activating the Air National Guard for firefighting. Under these procedures, if the CDF requires additional airtankers, it must route a request through the regional office of the U.S. Forest Service. The USFS regional forester must determine that all commercial airtankers within that USFS region are committed or unavailable. After making this determination, the regional forester notifies the Boise Interagency Fire Coordination Center, a body of federal agencies with wildland firefighting resources.* If the director of the Boise Interagency Fire Coordination Center then determines that all out-of-state commercial airtankers are committed and that the use of the Air National Guard C-130 would be appropriate, he sends a request through proper military channels to activate the guard aircraft.

* The agencies include the U.S. Forest Service, the Bureau of Indian Affairs, the National Park Service, the Bureau of Land Management, and the U.S. Fish and Wildlife Service.

Once the Air National Guard has been notified, it cannot respond to a fire until the MAFFS units have been loaded onto the aircraft and the military air crew has been summoned. All of these procedures extend the response time. Still, it is to the State's advantage to have the Air National Guard as a resource for those instances when sufficient commercial airtankers are unavailable.

Finally, because of this finding, we researched ways to reduce the time required to activate the California Air National Guard for aerial firefighting. One possible way, according to a Legislative Counsel opinion, is to have the Governor direct that guard aircraft be used for fire suppression during times of emergency. However, this could be done only if the guard is not in the active service of the Federal Government and if the use of the guard is not in conflict with any federal statute or regulation. Furthermore, arrangements would still have to be made with the U.S. Forest Service to ensure that, whenever the aircraft were provided, the MAFFS units would also be available. USFS officials indicated that they are reluctant to relinquish control of the MAFFS units because of possible commitments outside of California.

CONCLUSION

According to the federal policy, aircraft of the California Air National Guard cannot be mobilized and dispatched until it is determined that all out-of-state commercial airtankers are committed or unavailable. This process can take up to 24 hours. Nonetheless, we found that it is still to California's advantage to have the guard's aircraft available even if their use is restricted.

AERIAL FIREFIGHTING CONTRACTS
PROVIDE FOR EFFECTIVE COST CONTROL

The contracts administered by the California Department of Forestry for aerial firefighting services assure that costs are controlled. These contracts provide sufficient performance requirements and nonperformance penalties to assure that contractors perform satisfactorily. We found that contractors have satisfactorily complied with these requirements. In addition, we found that the CDF has implemented the provisions of the contracts by instituting procedures that effectively control expenditures for aerial firefighting.

To maintain and operate airtankers in California, the CDF contracts with private industry for aerial firefighting services. During fiscal year 1980-81, the department had five contracts with four firms for the maintenance and operation of 22 airtankers and 13 air-coordination aircraft. Additionally, the CDF contracted with six firms for maintaining and operating 9 helicopters. During fiscal year 1980-81, the CDF spent \$3.8 million for aerial firefighting contracts, and for fiscal year 1981-82, the CDF will budget \$3.1 million for these contracted services.

We found that current aerial firefighting contracts contain sufficient performance requirements and nonperformance penalties to control costs and to assure that contractors perform satisfactorily. For example, contract provisions require that aircraft and pilots be readily available to respond to emergency fire situations during designated periods. These periods coincide with the fire season and can be extended if necessary. The contract also stipulates that the CDF does not have to pay the contractor for periods when aircraft are unavailable for service. Another provision allows for sharing airtanker resources with other government agencies. Finally, other provisions specify the penalties that may be assessed when contractors fail to meet the standards of performance required by the contract.

The contracts require aircraft and pilots to be in a constant state of readiness during designated availability periods. These periods range from 107 days in northern California to 168 days in southern California, and they coincide with the peak fire season. Additionally, the contracts provide that, at the CDF's option, aircraft and pilots may be required to be available for up to 60 days before or 90 days beyond the designated periods. Under the terms of these contracts, the CDF only pays contractors to keep aerial firefighting services available for that part of the year when these services may be required.

Additionally, the contracts contain provisions that enable the CDF to exercise cooperative agreements with other government firefighting agencies. The major cooperative agreement is with the United States Forest Service, and it provides for the sharing of firefighting resources when it is efficient and effective to do so. Thus, for example, aircraft and pilots under contract to the United States Forest Service are available to the CDF on a reimbursable basis. The CDF also has cooperative agreements with the Bureau of Land Management, the Bureau of Indian Affairs, Los Angeles city and county fire departments, and the Ventura County Fire Department. Under the terms of these agreements, the CDF pays only for actual flight time of the aircraft; it does not pay agencies for keeping the aircraft on standby.

Finally, the contracts contain provisions allowing the CDF to assess penalties against a contractor who fails to meet the contract's performance standards. The contracts define what constitutes nonperformance and specify the severity of the penalty for instances of substandard performance. For example, if a contractor fails to perform adequately, the CDF can withhold payment for services. However, if a contractor's performance is unsatisfactory, the CDF can terminate the contract.

In our review, we found that contractors have generally complied with the performance requirements just discussed. CDF firefighting officials at the headquarters, regional, and local levels expressed satisfaction with contractors' performance. Specifically, contractors have met the requirements for complying with the mandatory and optional availability of aircraft and pilots, and they have complied with the cooperative agreement requirements.

Contractors have complied with requirements for keeping airtankers available during the fire season. In fact, aircraft and pilots were available during 98 percent of the time stipulated as the designated availability periods. This rate was in compliance with performance requirements, and it contributed to the CDF's ability to respond, previously mentioned in our report. Moreover, contractors have complied with requirements for providing aircraft and pilots for optional availability periods. For example, in 1980, the CDF required a 43-day extension under the optional availability provision specified in one contract. The CDF also exercised this requirement for several contracts in 1981 because of an early fire season. Discussions with department officials indicate that contractors have usually complied with the optional availability requirement.

Contractors have also met the performance requirements of the cooperative agreements. And according to the officer in charge of the CDF's command post, aircraft and pilots under contract to the United States Forest Service perform satisfactorily when used by the CDF under cooperative agreements.

Finally, the CDF has implemented provisions of firefighting contracts by establishing cost-saving procedures. There are two basic types of expenditures for which cost control procedures have been established: the rate paid to contractors for maintaining aircraft and pilots in a constant state of readiness, called the "daily availability rate"; and the rate paid to contractors for aircraft and pilot flight time, called the "hourly flight rate."

The CDF has taken several steps to control expenditures related to the daily availability rate. First, designated availability periods, coinciding with the peak fire season, have been established to control the number of days that a contractor is paid. Additionally, the CDF seeks competitive bids on the daily availability rate. Finally, the CDF requires that the contractor conduct a daily preflight maintenance and engine test. In this way, the CDF ensures that

it pays the daily availability rate only for the time that the aircraft and pilot are ready. The CDF does not pay the contractor when the aircraft or pilot is out of service.

The CDF has also taken several steps to control hourly flight rate expenditures. First, it is CDF personnel, not the contractor, who dispatch the aircraft. Additionally, CDF personnel monitor aircraft flight time by recording the time the aircraft is dispatched, the time the aircraft is due to arrive at the fire, and the time the aircraft actually does arrive. Furthermore, CDF personnel check on the reasonableness of aircraft flight time when they review contractors' invoices for flight time. Finally, the CDF controls flight time by using a pre-established system to dispatch available aircraft that are closest to the fire. Our review of selected data indicated that flight times in relation to distances traveled were reasonable.

CONCLUSION

The aerial firefighting contracts administered by the California Department of Forestry contain provisions that assure that costs are controlled. We found that these contracts provide sufficient performance requirements and nonperformance penalties to assure that contractors perform satisfactorily.

Additionally, we found that contractors were complying with all the major requirements of the contracts. Finally, we found that the CDF has implemented procedures that effectively control aerial firefighting expenditures.

STATE-LEASED AND CONTRACTOR-OWNED
AIRTANKERS HAVE SIMILAR FIREFIGHTING ROLES

We analyzed the roles of state-leased and contractor-owned aircraft in aerial firefighting and found them to be similar. Both are used for initial air attack, and both supplement ground firefighting forces. Additionally, both are maintained and operated by private industry under contract with the CDF, and both are subject to the same dispatch and control procedures. However, we did identify certain differences between state-leased and contractor-owned aircraft. Specifically, the contractor-owned aircraft are designed to carry more chemical retardant, are more costly to operate and maintain, and are out of service more frequently than are the state-leased aircraft.

As noted in the Introduction, the CDF's aircraft fleet comprises airtankers and helicopters. Some of the aircraft are leased by the State from the Federal Government; others are owned by the contractors. We found that state-leased and contractor-owned airtankers have the same aerial firefighting role: to contain fires by dropping retardant or water on them. Additionally, helicopters perform as airtankers and are highly maneuverable in rugged terrain. They also serve functions that airtankers cannot; that is, they

assist in transporting equipment, supplies, and personnel to fires located in areas that cannot easily be reached from the ground.

We found that both state-leased and contractor-owned aircraft are generally considered supplemental to ground forces because of flight limitations during periods of darkness, low visibility, or high winds. For example, during the 1980 Panorama Fire in southern California, high winds prevented the effective or safe use of aircraft for firefighting and seriously hampered ground operations. As a result, airtankers remained on the ground waiting for safe flying conditions while the fire burned.

State-leased and contractor-owned aircraft are also similar in that both are maintained and operated by private firms under contracts awarded after competitive bidding. The contracts require aircraft and pilots to be in a constant state of readiness during designated periods, and they provide the same standard method of compensation for daily availability and flight time.

We found that state-leased and contractor-owned aircraft are subject to the same dispatch and control procedures. The CDF dispatches the available aircraft closest

to a fire, regardless of whether they are state-leased or contractor-owned. Aircraft are dispatched according to a system that predesignates which air attack bases and aircraft are to be called first, based upon the intensity and location of the fire. In addition, we found that pilots' performance in flying to and from the fire and in making retardant drops is monitored by a CDF dispatcher and by an air attack officer at the scene of the fire. These officials check to see that flight times are reasonable, and they ensure that the flights are conducted in a safe manner.

In our review, we identified certain differences between state-leased and contractor-owned aircraft. The following table highlights the differences in retardant capacity, operating cost, and aircraft reliability.

TABLE 1
COMPARISON BETWEEN STATE-LEASED
AND CONTRACTOR-OWNED AIRCRAFT

	<u>State-leased Airtankers</u>	<u>Contractor-owned Airtankers</u>	<u>Contractor-owned Helicopters</u>
Retardant capacity	800 gal.	1,800 gal.	125 gal. ^a
Daily availability rate ^b	\$242	\$815	\$600
Hourly flight rate ^c	\$390	\$818	\$130
Out-of-service rate ^d	1.5%	5.7%	2.3%

^a Helicopters use water instead of retardant; thus, this figure represents water capacity.

^b These amounts represent the highest daily availability rates for contracts executed in 1980.

^c These amounts were taken from contracts executed in 1980. Hourly flight rates are adjusted monthly to reflect price changes in aviation fuel.

^d This represents hours that aircraft were out-of-service as a percentage of required availability hours during the 1980 fire season.

As indicated in the table, contractor-owned aircraft are able to carry more fire retardant, are more expensive to operate and maintain, and are out of service more frequently than are state-leased aircraft.

CONCLUSION

State-leased and contractor-owned aircraft serve the same general role of initial air attack in firefighting. This includes dropping retardant or water on fires in an effort to contain them and providing support to the firefighting force on the ground.

OTHER INFORMATION REQUESTED
BY THE LEGISLATURE

We have researched other areas requested by the Legislature. We determined how much the California Department of Forestry pays for converting state-leased aircraft to airtankers. We also noted that, to meet contract specifications, some airtankers are not loaded to capacity with retardant. Additionally, we examined the quality of aircraft maintenance and found that the CDF reduces costs by acquiring aircraft parts from federal surplus warehouses at reduced prices. However, problems in the CDF's system of inventory control may reduce these cost savings. Finally, we reviewed the capabilities of the aircraft used as airtankers.

Conversion Costs

In the Introduction, we discussed the aircraft the State acquired from the United States Navy through a long-term lease. These aircraft, known as S-2s, were formerly used for anti-submarine warfare. Seventeen S-2s currently operate as airtankers. In addition, 27 of these aircraft that have not been converted to airtankers are stored at a CDF warehouse. The CDF estimates that it would cost approximately \$350,000 to

convert an S-2 to an airtanker. Further, we estimated that the annual cost of operating each converted S-2 would total between \$205,000 and \$225,000.

Retardant Capacity

During our review, we found that certain types of aircraft are equipped to hold more chemical retardant than others. But to satisfy contract specifications used as part of the competitive bidding process, these aircraft are not filled to capacity.

Specifications for airtankers are established in terms of retardant capacity and aircraft capability rather than by type of aircraft. Thus, more than one aircraft may be able to satisfy the specifications for retardant capacity. For example, a DC-6A airtanker with a retardant capacity of 2,400 gallons would be able to satisfy the contract specification requiring 1,800 gallon retardant capacity. Suppose a contract for 1,800 gallons were awarded to the firm with a DC-6A airtanker. In that case, the airtanker would be loaded only to 75 percent of its capacity (1,800 gallons divided by 2,400 gallons), and it would still perform in accordance with contract specifications.*

* Presently, the DC-6A airtankers are the only aircraft used by the CDF that are not loaded to capacity.

Aircraft Maintenance

As mentioned earlier in this report, contractors maintained their aircraft and pilots in a constant state of readiness 98 percent of the required time. This high rate is in part the result of routine preventive maintenance conducted at the air attack base and major repair conducted at two separate facilities operated by contractors. Both of these repair facilities have been certified by the Federal Aviation Administration (FAA) as repair stations.

We reviewed 12 FAA inspection reports for one contractor's repair facility and found that aircraft are maintained by FAA-certified aircraft mechanics in accordance with FAA regulations. All but one of these reports rated the facility satisfactory. In that one exception, the FAA required the contractor to follow up on a deficiency, and the contractor immediately corrected the problem. In addition, during an interview, the regional chief of the FAA stated he was impressed with the quality of maintenance performed at these facilities.

The CDF's Use of Surplus Military Parts

We found that the CDF acquires aircraft parts at reduced prices through a federal excess property program and from military supply depots. We examined selected purchases of aircraft parts from these sources and identified instances of considerable cost savings. For example, the CDF indicated that it saved \$236,000 by purchasing 50 main landing gear brakes (a frequently used part) from the United States Navy instead of from commercial vendors. By using surplus military aircraft and parts, the CDF has considerably reduced the cost of maintaining its airtankers and observation aircraft.

Inventory Management

We visited the CDF warehouse facility located at the Fresno airport. This facility occupies over three acres and is used to store aircraft and parts. An indoor section houses aircraft parts, and an open area contains 27 unmodified military surplus S-2s, 6 observation aircraft, and other partially assembled aircraft. We found that the inventory management system used at this warehouse facility needs improvement.

Warehouse personnel have instituted a basic inventory management system that only verifies purchase orders and describes each item and its cost. However, the system appears to lack sufficient procedures for controlling and disbursing parts and for identifying the condition of parts. For example, most of the parts were not categorized as either ready for installation, repairable, or unserviceable. Also, there was no schedule for overhauling repairable parts. We also found that the warehouse maintains hundreds of infrequently used surplus parts. This excessive inventory reduces the potential for maximizing cost savings.

The CDF has just conducted a feasibility study of an aircraft parts inventory system. The study, which was published while this report was being written, notes that the present system does not effectively locate aircraft parts, and it presents six recommendations. The study recommends that a private time-sharing service be obtained and that parts inventory be put on a computer.

In addition to the recommendations included in the CDF study, we suggest that the CDF have its materials management personnel monitor the warehousing activity, establish inventory levels, and define the responsibilities of the contractors regarding the use and repair of aircraft parts.

Characteristics of the Different Types of Airtankers

Various types of aircraft have been used as airtankers for firefighting, and each type is somewhat different. Basically the two types of airtankers are helicopter and fixed-wing aircraft. The fixed-wing airtankers can be further classified by their retardant capacity: small, medium, and large. The traditional fixed-wing airtanker, including all of those in the CDF fleet, are loaded with chemical retardants while on the ground at an air attack base. There is one type of fixed-wing aircraft, however, that is capable of reloading by scooping water while in flight.


During our review, we attempted to examine the role, characteristics, capabilities, and limitations of each type of aircraft. We interviewed CDF officials as well as personnel not associated with the department. We met with urban firefighting personnel, federal officials who certify airtankers, an aeronautical engineer, and representatives of property owners' associations in fire-prone areas. Following our discussions, it became apparent that we could not adequately assess the technical or aeronautical capability of each type of aircraft. However, we found a general consensus concerning certain characteristics.

Some of the people we interviewed recognized a need for both small and large capacity airtankers. The smaller 800- to 1,200-gallon capacity airtanker is necessary because of its maneuverability and its ability to operate from a variety of airfields, many of which are not capable of supporting the weight of the larger, four-engine, 2,000- to 3,000-gallon capacity aircraft.

Several people also agreed on the versatility and utility of the helicopters, especially in serving the urban areas in southern California. In fact, fire officials in both the city and county of Los Angeles have purchased helicopters because of their greater maneuverability and utility. Although the helicopters have less retardant capacity than fixed-wing aircraft, the Los Angeles officials felt that helicopters could perform better in the canyons and rough hillsides within the area. The helicopters also serve functions that airtankers cannot by providing logistical support. In addition, helicopters can be used in fighting fires in high-rise buildings.

Further, it was also the opinion of a county fire official that sufficient fixed-wing airtankers were available to supplement their helicopters during periods of increased demand.

Respectfully submitted,


THOMAS W. HAYES
Auditor General

Date: November 19, 1981

Staff: Eugene T. Potter, Audit Manager
John B. Schmidt
Edward J. Pierini, Jr., CPA

Memorandum

To : Mr. Thomas W. Hayes
Auditor General
Office of the Auditor General
660 J Street, Suite 300
Sacramento, CA 95814

Date: November 9, 1981
F 1

Telephone: ATSS (916) 485-9882
(916) 445-9882

From : **Department of Forestry**


Subject: 8300 AIR ATTACK
General

I concur with the findings you have arrived at and published in the draft report entitled "A Review of the California Department of Forestry's Aerial Fire-fighting Program."

Action has already been taken to strengthen the aircraft parts inventory management system. In addition to the feasibility study concerning computerizing the inventory system, the Department has hired a qualified aircraft parts manager to supervise the aircrafts parts facility.

In your report you note that the CDF estimates the cost of converting an S-2 to an airtanker to be \$150,000. Your quote was correct at the time the information was provided to the auditors. Our most recent estimate of work required places the conversion cost at \$350,000 per aircraft.*

I appreciate the opportunity to review and comment on this report before it is printed in final form.



DAVID E. PESONEN
DIRECTOR

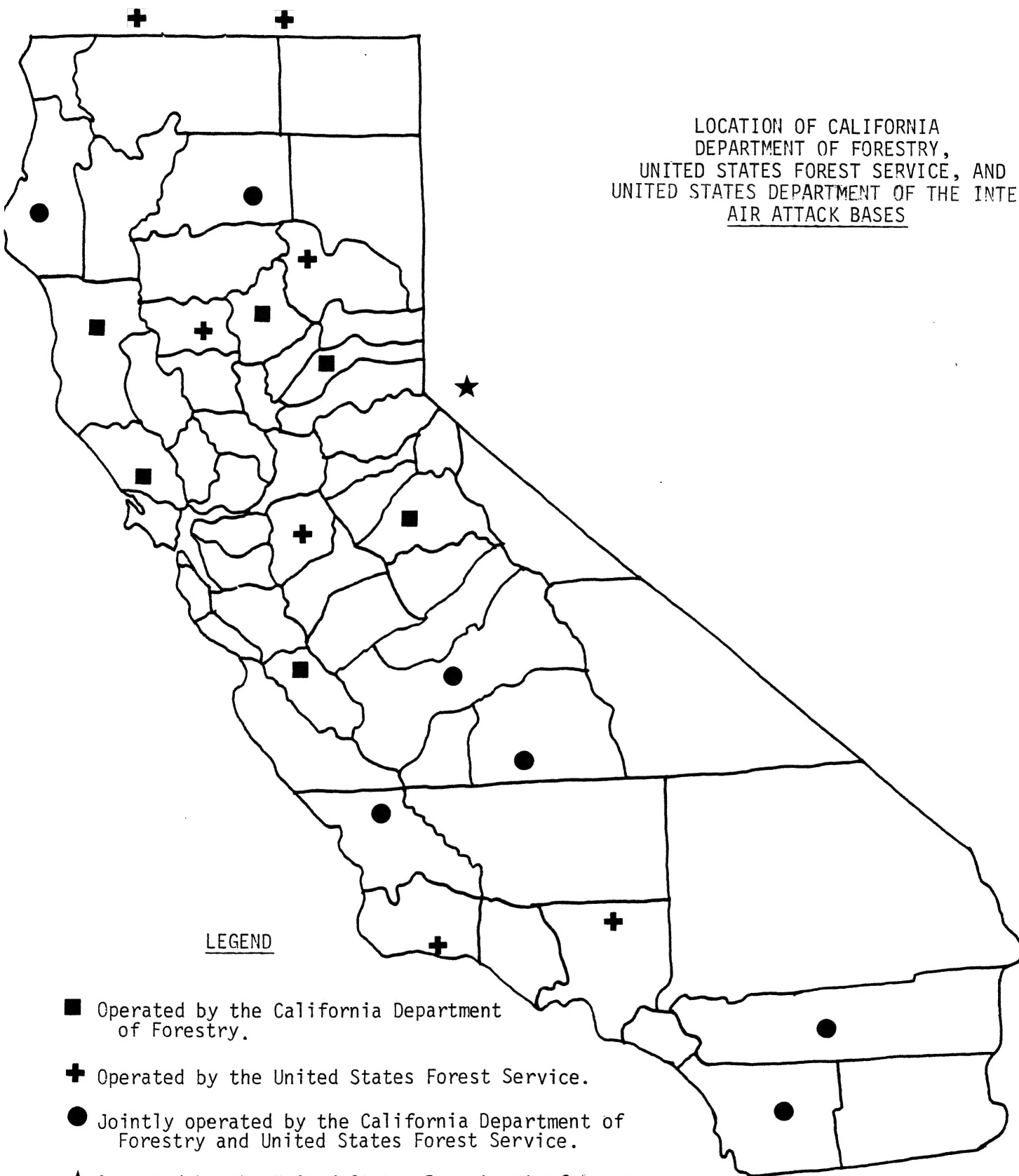
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* Auditor General Comment: The conversion cost contained on page 32 of our report was revised to reflect the most recent estimate of \$350,000 per aircraft.

LOCATION OF CALIFORNIA
DEPARTMENT OF FORESTRY,
UNITED STATES FOREST SERVICE, AND
UNITED STATES DEPARTMENT OF THE INTERIOR
AIR ATTACK BASES

LEGEND

- Operated by the California Department of Forestry.
- ✚ Operated by the United States Forest Service.
- Jointly operated by the California Department of Forestry and United States Forest Service.
- ★ Operated by the United States Department of the Interior.



cc: Members of the Legislature
Office of the Governor
Office of the Lieutenant Governor
Secretary of State
State Controller
State Treasurer
Legislative Analyst
Director of Finance
Assembly Office of Research
Senate Office of Research
Assembly Majority/Minority Consultants
Senate Majority/Minority Consultants
California State Department Heads
Capitol Press Corps